Claims

1. A gear-clutch assembly (2) organized about an axis and comprising:

a gear (10) having grooves (10c) that open inwardly toward the axis and extend axially;

a hub (12) located within the gear (10) where it is capable of rotating within the gear (10), the hub (12) having grooves (12k) that open outwardly away from the axis and extend axially;

keys (17) located within the grooves (12k) of the hub (12) and being capable of moving radially toward and away from the axis, the arrangement being such that when the keys (17) are permitted to move away from the axis, at least one will enter one of the grooves (10c) in the gear (10) to couple the gear (10) and hub (12) so that they will rotate in unison;-

wherein the number of keys (17) is evenly divisible by the difference in the number of grooves (10c and 12k) between the hub (12) and the gear (10); and

an actuator (3) for effecting radial displacement of the keys (17).

2. An assembly (2) according to claim 1 and further comprising springs (18) for urging the keys (17) outwardly away from the axis; and wherein the actuator (2) when energized moves the keys (17) inwardly toward the axis.

3. An assembly (2) according to claim 3, wherein the actuator (3) comprises:

an electric coil (21) axially fixed about the keys (17);

a plunge ring (23) capable of moving axially about the keys (17);

wherein the electric coil (21) when energized moves the plunge ring (23) axially toward the electric coil (21) so that the plunge ring (23) pushes against ramp surfaces (17c) of the keys, thereby moving the keys (17) inwardly toward the axis; and

wherein the springs (18) when the electric coil (21) is de-energized urge the keys (17) outwardly from the axis so that the ramp

surfaces (17c) of the keys (17) push against the plunge ring (23) to move the plunge ring (23) axially away from the electric coil (21).

4. An assembly (2) according to claim 1, further comprising means for absorbing torsion impact loads.

5. An assembly (2) according to claim 4, wherein the means for absorbing torsion impact loads comprises:

an internally splined ring (15) located within the hub (12) having a ramped face (15b) and having splines (15c) engaged with a supporting shaft (30) so that the internally splined ring is rotationally fixed to the supporting shaft (30);

an externally splined ring (16) located within the hub (12) having a ramped face (16b) engaged with the ramped face (15b) of the internally splined ring (15) and having splines (16c) engaged with the hub (12) so that the externally splined ring (16) is rotationally fixed to the hub (12) and moves axially within the hub (12);

a spring (14) located within the hub (12) biasing the externally splined ramp (16) axially against the internally splined ring (15), wherein rotation of the internally splined ring (15) relative to the externally splined ring (16) compresses the spring (14).

6. A method of operating a gear-clutch assembly (2) organized about an axis, comprising the steps of:

providing a gear (10) having grooves (10c) that open inwardly toward the axis and extend axially;

providing a hub (12) within the gear (10) where it is capable of rotating within the gear (10), the hub (12) having grooves (10c) that open outwardly away from the axis and extend axially;

providing keys (17) within the grooves (12k) of the hub (12), the keys (17) being capable of moving radially toward and away from the axis, the arrangement being such that when the keys (17) are permitted to move away from the axis, at least one will enter one of the grooves (10c) in the gear (10) to couple the gear (10) and hub (12) so that they will rotate in unison;

wherein the number of keys (17) is evenly divisible by the difference in the number of grooves (12k and 10c) between the hub (12) and the gear (10); and

providing an actuator (3) for effecting radial displacement of the keys (17);

energizing the actuator (3) to uncouple the keys (17) with the gear (10); and

de-energizing the actuator (3) to couple the keys (17) from the gear (10).

7. The method of claim 6 further comprising the steps of providing a means for absorbing torsion impact loads.

8. The method of claim 7 wherein the means for absorbing torsion impact loads comprises:

an internally splined ring (15) located within the hub (12) having a ramped face (15b) and having splines (15c) engaged with a supporting shaft (30) so that the internally splined ring (15) is rotationally fixed to the supporting shaft (30);

an externally splined ring (16) located within the hub (12) having a ramped face (16b) engaged with the ramped face (15b) of the internally splined ring (15) and having splines (16c) engaged with the hub (12) so that the externally splined ring (16) is rotationally fixed to the hub (12) and moves axially within the hub (12);

a spring (14) located within the hub (12) biasing the externally splined ramp (16) axially against the internally splined ring (15) ; wherein rotation of the internally splined ring (15) relative to the externally splined ring (16) compresses the spring (14).